Space Weather Technical Forecast

Issued on Tuesday, 11 April 2023 at 12:02 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of M-class flares (R1-R2 Minor-Moderate radio blackouts) throughout.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity has been Moderate with an M2 flare peaking at 11/1016 UTC from AR3272. There are currently six sunspot regions on the visible disc. AR3276 gave an M-class flare yesterday and is gradually rotating into view on the southeast limb, but currently consists of three small spots although further details may become apparent as it moves further onto the disc. AR3272 is the largest region on the disc, situated in the southeast quadrant. This consists of a large number of individual small spots. AR3273 near north centre disc has also shown some growth in the last 24 hours, but currently appears fairly simple. The other regions appear to be small and simple at the present time.
There have been no Earth-directed CMEs observed in available imagery. We are awaiting imagery after the recent M-flare to see if any CME was produced, as this region is well placed to give an Earth directed CME.

Solar Wind / Geomagnetic Activity: The solar wind as observed by DSCOVR at L1, has shown a weak High Speed Stream (HSS) enhancement likely from CH91/+ over the last 24 hours. Wind speeds were initially 480-550km/s but eased slightly and are now around 420-480 km/s. Density started above average, but is now around average. The total IMF, Bt, has been weak to moderate, peaking early in the period at 10 nT. The north-south component, Bz, has been varying weakly between +7/-5 nT, but has been mostly northward directed. The phi angle was mainly positive (away from the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) as measured at GOES16, was at background levels. The high energy electron flux (greater than 2MeV) as measured at GOES16 was at background levels. The associated 24 hour fluence was below the Active threshold with a declining trend. The 11/0000 UTC observed fluence was 1.84e6 integrated pfu.

Four-Day Space Weather Forecast Summary
Solar Activity: Solar activity is expected to be Low to Moderate, with a chance of further isolated M-flares. AR3272 and AR3276 are the most likely sources of activity.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs, although there is with a low possibility of a glancing arrival from a CME which left the Sun on the 7 Apr, either late Day 1 or early Day 2 (11 or 12 Apr). Ongoing slightly elevated or perhaps elevated winds are expected, with further coronal hole sourced enhancements possible, however any geomagnetic activity is likely to remain limited. Mainly Quiet activity expected with a chance of Unsettled intervals and a very slight chance of Active if any CME arrival occurs.

Energetic Particles / Solar Radiation: High energy (greater than 10MeV) proton flux is expected to persist at background levels. High energy (greater than 2 MeV) electron flux is expected to be at mostly background levels, perhaps peaking at moderate or high levels later in

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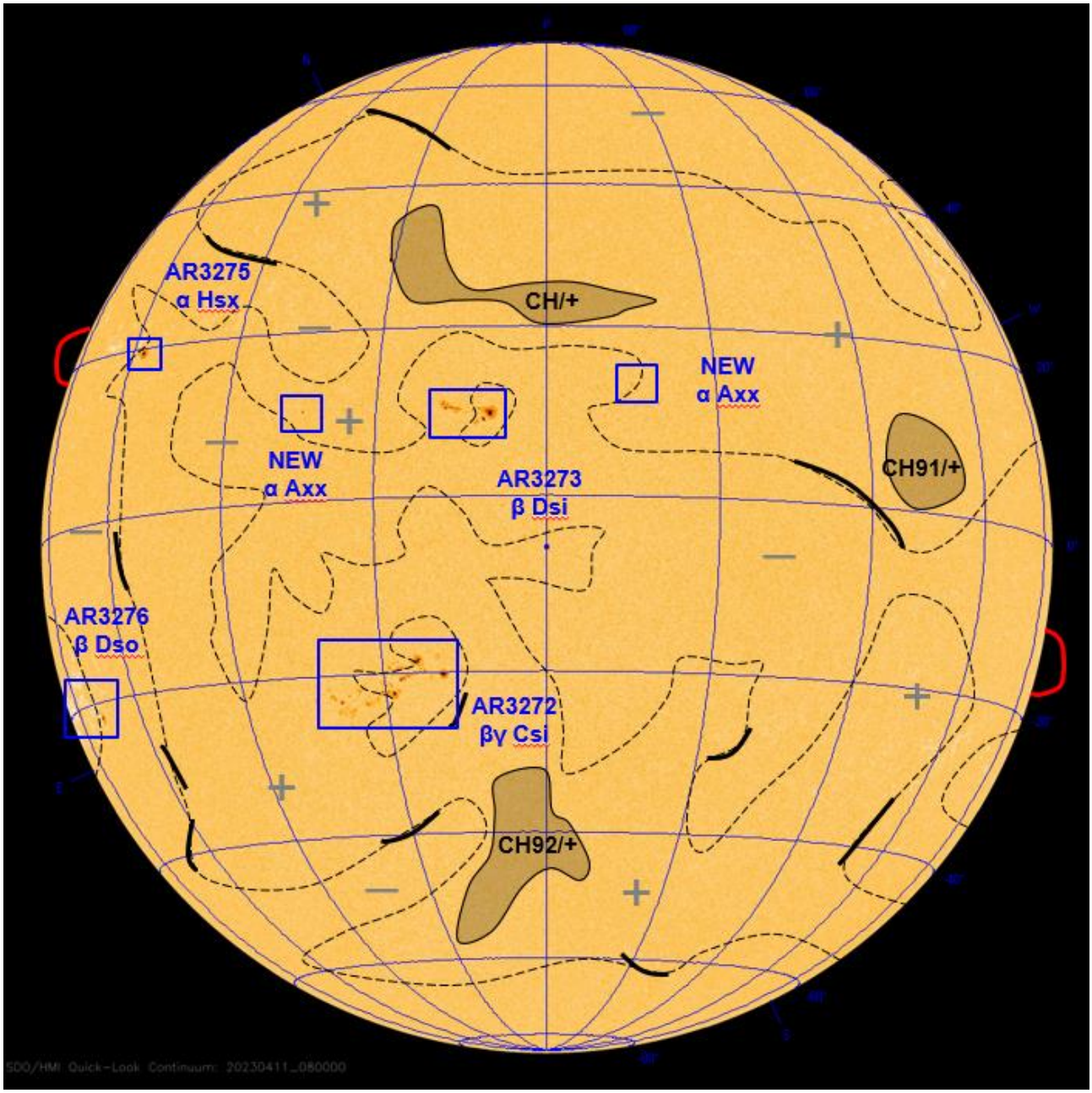
the period. The associated 24 hour fluence is expected to remain below the Active threshold (1e8 integrated pfu), perhaps on a slight rising trend.

Figure 1. Solar Analysis Valid 11/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

There are no Earth-directed CMEs. However, there is a slight chance of a glancing interaction either late Day 1 or early Day 2 (11/12 Apr) due to a CME from 07 Apr. This is most likely to miss, passing south and ahead of Earth's position.

Earth is currently in weak HSS conditions, associated with CH91/+. The longevity of these winds is low confidence as the fast wind enhancement is missing from Enlil, while the 27-day persistence is contaminated by the arrival of a CME on the last rotation. Furthermore, a latitudinally narrow, but longitudinally broad coronal hole is situated across the northern disc, albeit somewhat obscured by the looping on the disc. In Enlil its associated fast wind can be seen passing above the Earth, only fading away on Day 4 (14 Apr). A further southern coronal hole (CH92/+) may also give an enhancement on Day 4.

These features give a potential for Earth to see slightly elevated or perhaps elevated winds throughout the period however due to their positive polarity and the time of year, any geomagnetic enhancement is expected to remain subdued (Russell-McPherron effect). Mainly Quiet conditions are expected throughout, with isolated Unsettled spells and only a slight chance of Active intervals, mainly on Days 1 or 2 due to any slight CME glance that may occur.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	5	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
08/0107	Partial	Filament	SW	388 km/s	12/0300 UTC	Most likely to miss but low chance of a glancing blow

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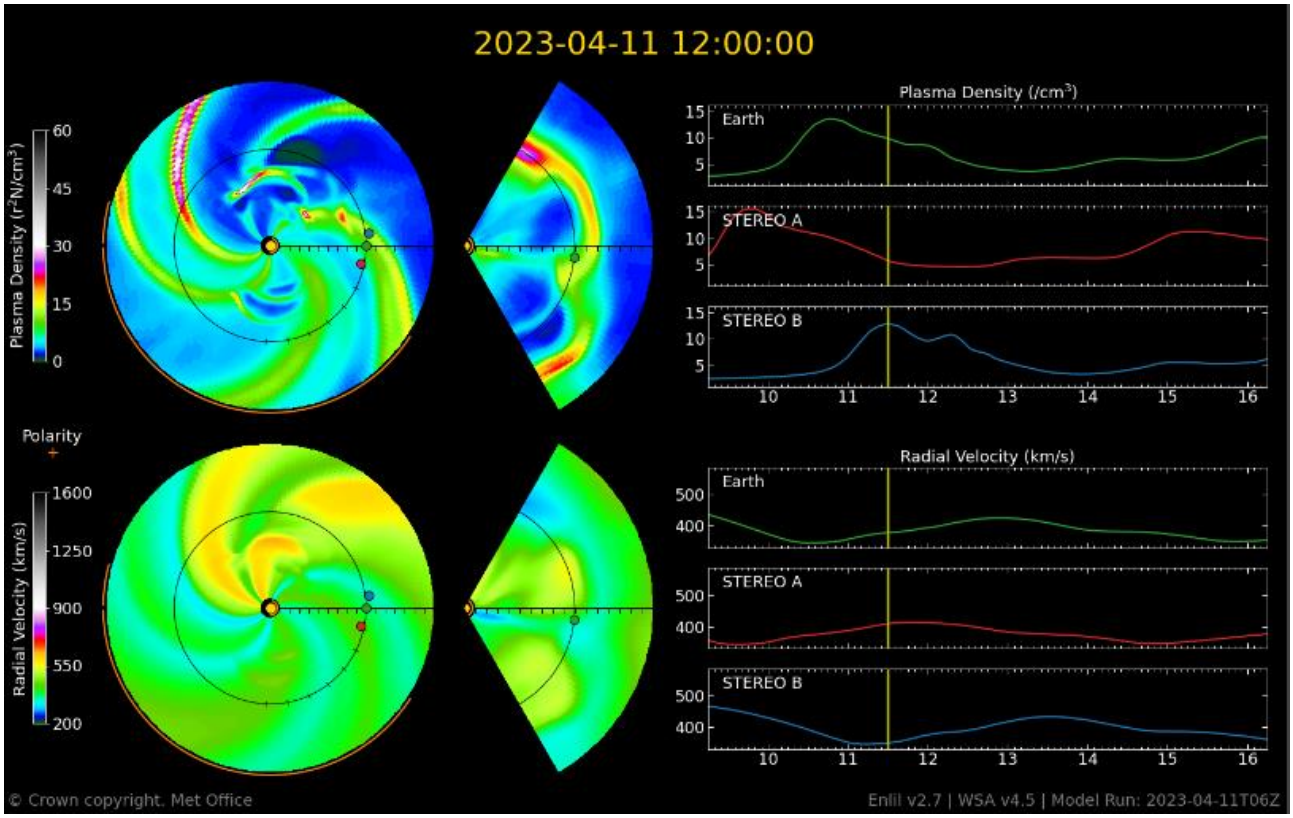
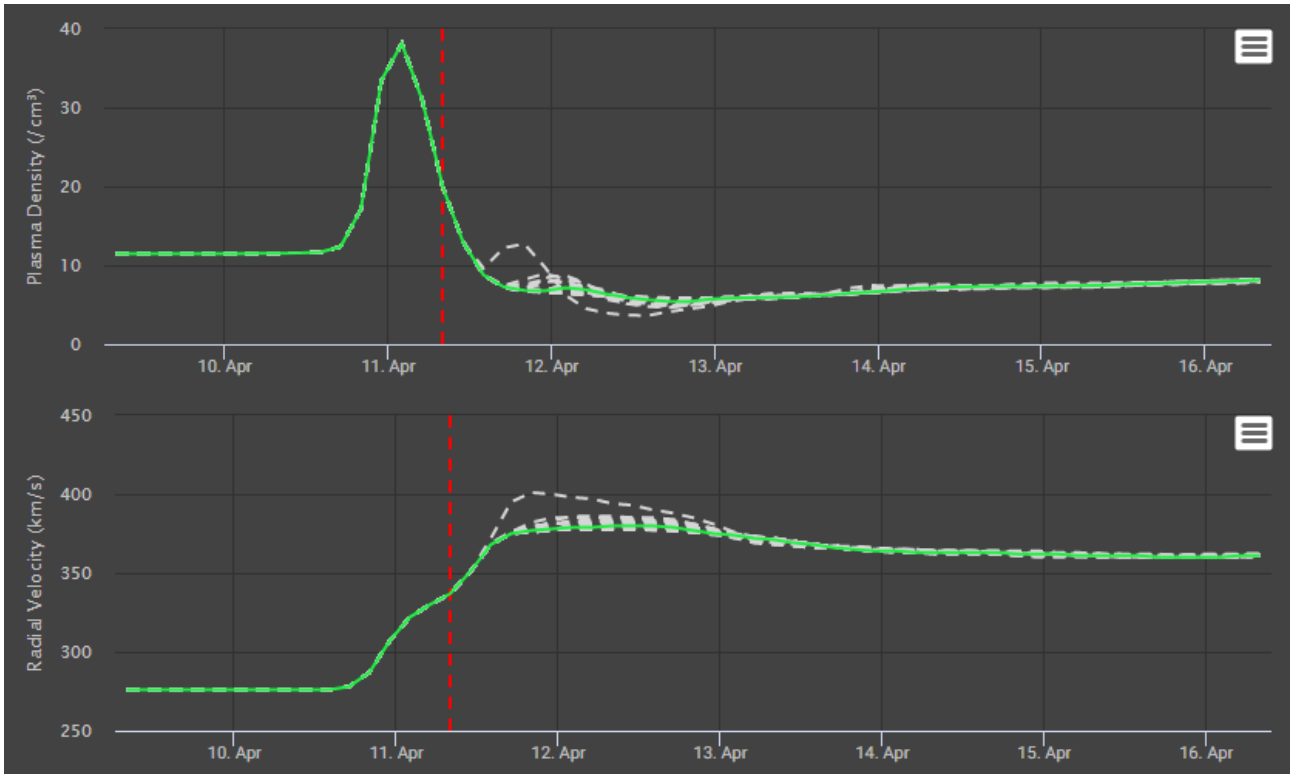
Figure 2: MOSWOC Enlil and ensemble. Enlil has not captured the current HSS, but is suggesting an increase which appears to be associated with the northern coronal hole. Overall, wind speeds are likely to be higher than forecast by Enlil over the next few days. Some ensemble members are suggesting a possible glancing CME blow tonight.





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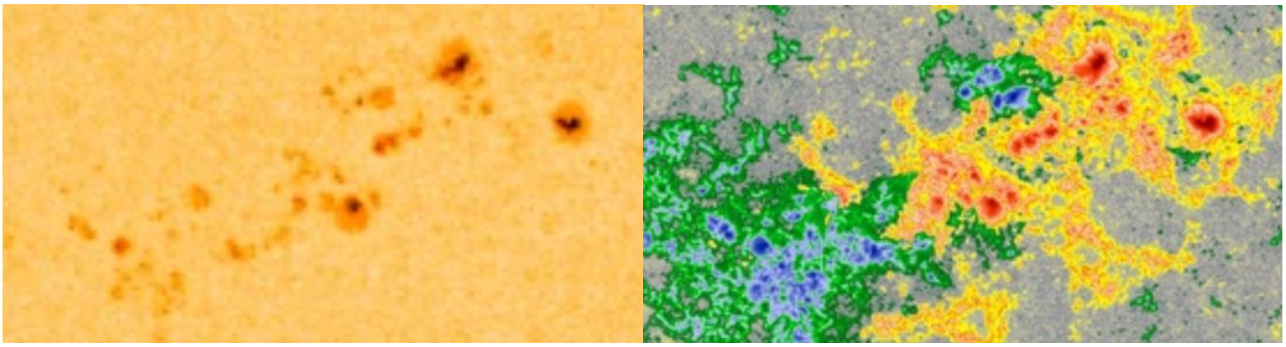
Radio Blackouts - X-Ray Flares:
Low to Moderate activity is expected to continue with the ongoing chance of isolated M-flares. There are two sunspots which have a history of M-flaring, along with frequent low level C-flares. AR3272 is a moderately sized region in the southeast quadrant, but is comprised of multiple small spots, and with some limited magnetic complexity due to a couple of small reverse polarity spots near the main negative leaders. It has shown some fading of the penumbral area on the trailing spots. AR3276, however, is more difficult to assess, as it has only recently rotated into view from around the southeast limb. On the far-side this appeared to be a source of a number of CMEs, and it has a bright appearance in SDO aia-094. Despite this, only very small spots are currently visible along with nearby faculae. More complexity may become apparent over the coming days as it moves into a less oblique viewing angle.

Further regions are also present on the disc, with AR3273 also showing some notable growth, although this has a simple bipolar magnetic structure. Along with a few further smaller spots, there is a current trend to increasing activity and further sunspot development appears likely.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	40	40	40	40
Very Active	R3 to R5 X Class	No	2	2	2	2

Figure 3: AR3272 showing numerous small spots, with some small positive spots near the negative leaders.



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Solar Radiation Storms - (High Energy Protons):
High energy proton flux (greater than 10MeV), as observed by GOES-16, is likely to remain at background levels through the period. The majority of the sunspots on the disc are in the eastern hemisphere and currently unlikely to produce strong flares, however there is a very slightly increased risk late in the period as these, including AR3272 rotate into the western disc.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	2	2	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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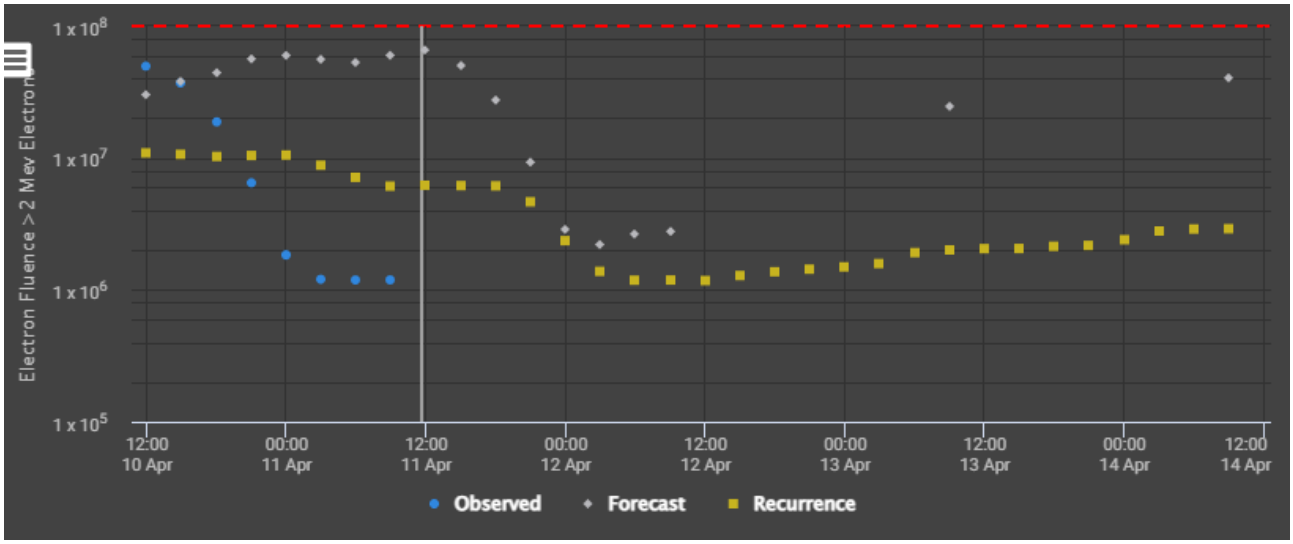
High Energy Electrons Event (≥ 2MeV):
The high energy (greater than 2 MeV) electron flux is at background levels and any rise due to the current observed solar wind enhancements is expected to be subdued. Peak diurnal values may reach moderate or perhaps high levels by the end of the period, but any rise is expected to be fairly modest.

The associated 24 hour fluence is expected to be below the Active (1e8 integrated pfu) threshold throughout, but perhaps with a slight rising trend. REFM is suggesting a minor rise and is likely to be giving good guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	5	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: MOSWOC REFM suggesting a slight increase below Active (1e8 integrated pfu) through the next few days.



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